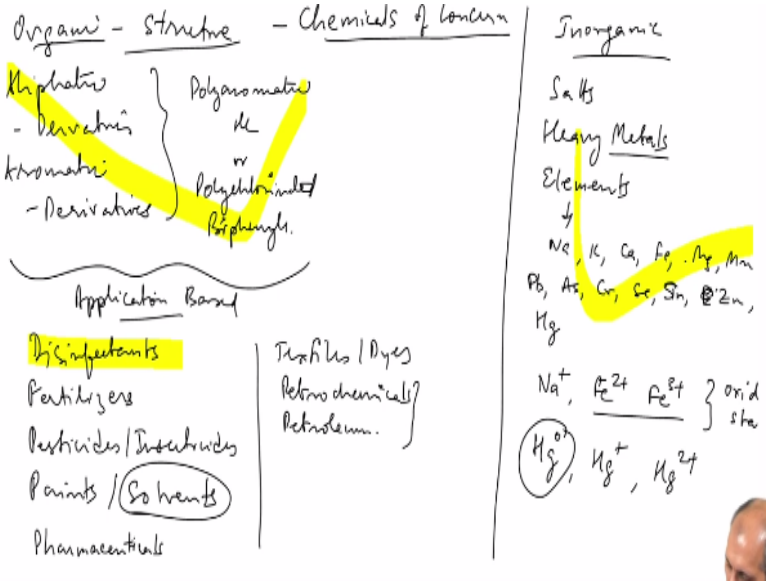
Environmental Quality: Monitoring and Assessment
Prof. Ravi Krishna
Department of Chemical Engineering
Indian Institute of Technology – Madras

Lecture – 3
Water Quality Screening Parameters

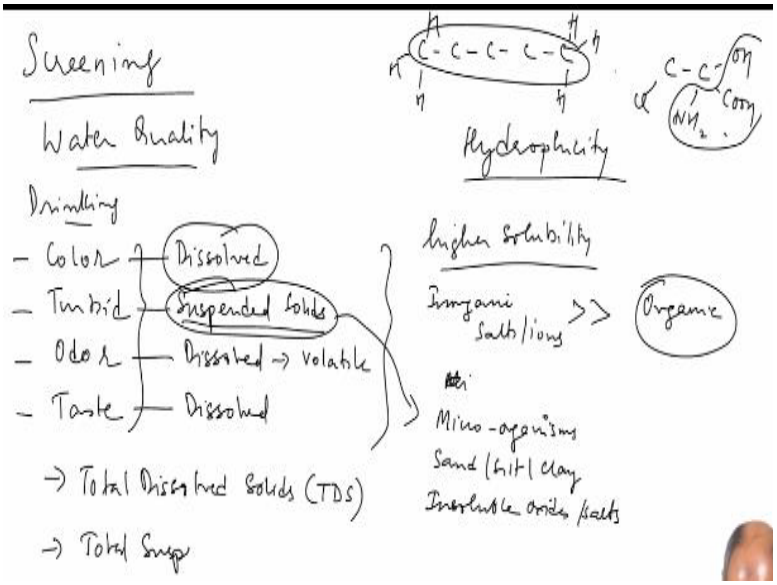
(Refer Slide Time: 00:18)



This information can be put it in a different format, so we have to step back, okay. So if somebody comes and asks is the water contaminated, is water safe to drink? So your answer cannot be, your absolute final answer can be okay give me a month's time, I will analyze whether it contains all the one lakh chemicals that we know that are that exist in nature and then I will tell you in a month's time, that is not acceptable, people won't wait for that long. So you need a quick answer.

What is this quick answer, quick answer can never be a detailed answer, it has to be a short answer, but it gives you partial information, whether you. So we do whenever we do such things, we need a quick answer, we need what is called as Screening.

(Refer Slide Time: 01:06)



Screening, we do a preliminary analysis and we say is this good or bad? Now, this is a very, it's a bit, it's it's not a very from a scientific or rational point of view, you know that the answer could be wrong, but at least you have some sense of what is happening, what is there and whether where you should where you should put your these things, okay. So, from a screening point of view, this is when we get to the classification of what are pollutants, what what kind of, where should where we should put our efforts. So screening for water quality, how would you screen a water sample?

By just looking at it, can you screen a water sample? Keep in mind all the discussion we had in the previous slide, where we talked about chemicals and all that, but when we look at water quality itself, what do you look for water so our water quality again? When somebody gives you a water sample, so what is the first question you ask them? When somebody says please tell me if it is ah good water? So your question, what is your follow up question? Somebody says tell me something about water quality, what should be your question return question?

Student: Source.

Professor: Good for what, the question is good for what?

Student: Drinking.

Professor: So drinking is the most the highest quality because we are concerned about that. So if you say you have to specify that. This is again related to economics and the resource we have because if we have we are seeing the problem now, everywhere. We want drinking water, we want drinking water quality. The amount of water that we drink is not the same as

the amount of water we use for washing or some other purposes and we have to decide whether we use the effort to clean up the water to that extent.

So so drinking water, what will you look for in drinking water? When somebody gives you a glass of water, when will you not drink the glass of water?
Student: If it is coloured,
Professor: if it is
Student: coloured if it is coloured
Professor: if it is
Student: turbid
Professor: if it is turbid, it means it is just not clear. Coloured it's clear, but it is not colorless, it is something. Then
Student: smell
Professor: smells or we call it as odor, when you smells, it looks it looks clean and it looks clear, but it smells, something is smelling, yeah. Then all these three are good, then you take it in your mouth, it does not taste good. Beyond these, these are visible parameters. You will quickly know that.

Suppose it is none of this above, if you drink it, there could still be something in the water which does not give any of these, but these are very good preliminary screening factors, okay. You could have a quantitative aspect to this, which means you could what does it color, color means what could be there in the water. Hmm.. It is not turbid, it's clean, it's clear, but it is coloured. What could be a chemical, in what form and what? So, it's a chemical that is usually the definition that we give is dissolved, it's dissolved.

You have to make very clear distinction between a few things here. Dissolve is it is in the structure of the water and I think it does not form any precipitate, it is dissolved, clean, clear. Salt water for example, if you dissolve salt or sugar, it is dissolved. You will see a clear solution okay, which means it is dissolved, it's chemically dissolved, okay. Turbid is not dissolved. The the technical term that we use for this is Suspended Solids, something is suspended, means it just floats in the water.

Odour is also dissolved because this you cannot see it, but you can smell it, that it is volatilizing, it has been getting out of water slowly that is an indicator. Taste which also

means it's dissolved. So, you have a bunch of things that can be there in the water which are either suspended or dissolved, that is all, 2 states, okay. So there are variety of chemicals. So in water, the chemicals have a wide range of solubilities, they can dissolve to different extents in the water, okay, so we will come to those.

So, we are looking at a large number of chemicals which are which may be present in the water in the dissolved state. Yeah, so which of the compounds are important from a dissolved point of view, which are likely to have higher solubilities. Which compounds are likely to have a high solubility in water, organic or inorganic, make make a guess
Student: inorganic.
Professor: Inorganic mostly. Ions, things like ions they they form, they form solution in water. So large number of inorganic salts, ions, they have very high solubility in water.

You can also have organic compounds which are dissolved in water, but organic compounds by nature, organic compounds there is a classification of chemicals here, that that that makes it important. So, for example, a compound that has a dis a classification a structure that looks like this C-C-C-C-C- and hydrogen here and here and so on. By definition, these these kind of compounds many of these compounds which have very large number of C's do not like water, they do not have high solubility in water.

If you look at the data of solubility versus the number of carbons, it is usually decreasing with the number of carbons as you, but if you have a group here, say I have a compound with an OH group or a COOH group or an NH_2 or some such thing or even chlorine sometimes, some of these have higher solubilities in water than something that does not have 'H', but still these compounds are not in comparison to inorganic salts, the solubility is very low.

So there is one thing that you have to understand straightaway that many of these organic compounds also have solubility, all of them have solubilities, it's it's just low, it's just water doesn't like water, but it can be present in water, okay. And will look at that in the first assignment that will give to you as a chemical property assignment where you have look at bunch of chemicals, different classifications and then find out properties and then analyze the properties and what it means.

So, there is this term which is called as Hydrophobicity, we will come come back to this term later, the context of this is not with the in the in solubilities, it's something else, so it is relative, okay, Anyway, so organic components also can be present, it's finite solubility, but this is larger. For this one, solubility is very large, much much larger than that of organic compound, okay.

So, what about suspended solids? What do you think are there in suspended solids? What is the classification what what type of material can be suspended in water, which means it is not dissolving, it's an insoluble precipitate compound that doesn't dissolve in water or it can be suspended. Which are all can you give any examples of what all can be other materials that you can just suspend,

Student: detergent?

Professor: No, detergent is soluble at some concentrations as a different class, detergents are very different. Detergents will suspend, if I change amount of water, it will all become dissolved, it depends on the concentration. As once you change the concentration, it will dissolve, but this will not dissolve. Suspended solids won't dissolve under any under any condition. They are chemically they are not they cannot dissolve in water, okay. So it doesn't doesn't matter how much water you have or you add anything else, they are suspended, unless you destroy them or remove it out of it. Somebody said something else, ah?

Student: carbonate.

Professor: Carbonate, what is carbonate, what is the form, what kind of?

Student: Magnesium carbonate, calcium carbonate. Yeah, so these are precipitates, these are insoluble precipitates. There are some salts which are insoluble, so those are present. There are some oxides which are insoluble, so those are present. And there is all components that we discussed in soil yesterday, sand, silt, clay, they are all there, they are all part of the ugh the suspended. There is one other group of suspended particles we have not discussed in the class so far, what is that, which imparts turbidity to water, but it is not part of the inorganic list of inorganic chemicals you just mentioned.

You mentioned insoluble salts, precipitates, sand, silt, clays, all these are there. There is one other group of suspended particles suspended matter that can that that will constitute part of suspended solids.

Student: plastics

Professor: No, the plastics is all new, microplastics and all that. We are talking about something traditionally there. What will you do, if you don't do any of these things to water? If I give you a clear sample of water, then if you see you see it is a turbid sample of water, what you normally do for water before you drink it? Yeah. What is the minimum that you will do to water, filter, then

Students: Boil

Professor: Boil it. Sometimes filtration itself will work, we don't need boiling, what does that mean? So, whatever you are boiling for is there in the filterable part also, so what is that, what compound, what is the entity that we are trying to remove or destroy?

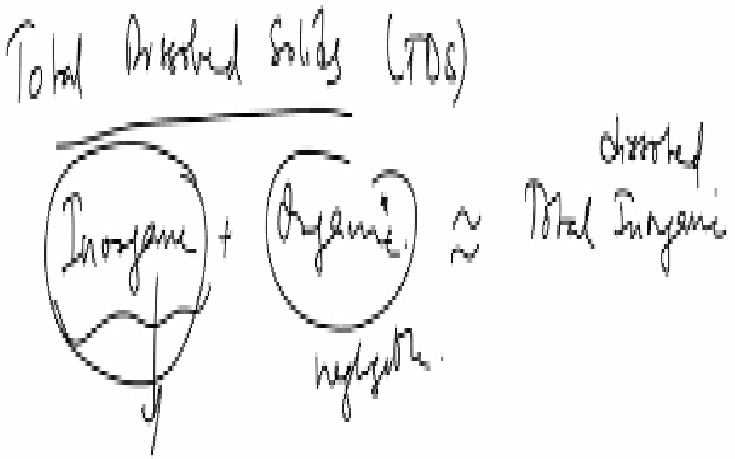
Students: Microbes (micro-organisms)**.**

Professor: microbes. So microorganisms also, they are organisms, they have a certain size, they are floating, different size depending on what form they are in.

So, again we are we are doing a lot of classification, we are again the length is increasing, the list is increasing, we have microbes, we have sand, silt, clay and all these these things, okay. So, here we have we have one group that can be dissolved, another group that is suspended, very simply. Water quality itself you can classify now as if you measure the total dissolved components and the total suspended components. This this you will get a very simple classification straightaway.

So, one of the water quality parameters is we call it as total dissolved solids. See the word solids is a very it is a misnomer here, it is not a it's not an insoluble solid, it's a solid. People have used this term, it is called as TDS and the other one is total suspended solids TSS.

(Refer Slide Time: 14:21)



So we look at, I'll just finish up in a in just a minute, total dissolved solids. Normally is this it is inorganic plus organic, you know. What we know that in compounds, in most of the water samples, this dominates this dominates. This is very high as we have already seen. The definition the strict definition of total dissolved solids is everything, organic and organic everything together okay, but because inorganic dominates, we disregard the organic part wherever this is suitable because if you are able to measure inorganic very easily, usually the we approximate this TDS total inorganic, total dissolved inorganic.

What that does is the way you measure total dissolved inorganic is very different from way you measure organic dissolved and inorganic total completely. So, if you make the assumption that this is approximately the same as this, which means this part is negligible, I cannot measure it when compared. Then this TDS becomes a very simple measurement, it is an easy way to measure it, okay. So.